

in: North Dakota, 34 per cent; Maine and Minnesota, 72; Montana, 53; Wisconsin, 39.

Auroras were reported most frequently in: Minnesota, on 14 days; North Dakota and Wisconsin, 11; Montana, 8; New York and South Dakota, 7.

CANADIAN DATA—THUNDERSTORMS AND AURORAS.

Auroras were reported as follows: 2d, Quebec. 4th, Qu'Appelle. 14th, Halifax, Quebec, Montreal, Winnipeg, Minnedosa, Qu'Appelle, Calgary, and Prince Albert. 15th, Grindstone, White River, Minnedosa, Qu'Appelle, and Prince Albert. 16th, Montreal, Port Arthur, and Winnipeg. 17th, Quebec, Port Arthur, Winnipeg, and Minnedosa. 18th, Quebec, Winnipeg, Minnedosa, Qu'Appelle, Swift Current, and Prince Albert. 19th, Charlottetown and Port Arthur. 20th, White River. 23d and 24th, Minnedosa. 29th, Toronto, Minnedosa, and Prince Albert. 30th, Port Arthur, Winnipeg, and Prince Albert.

Thunderstorms were reported as follows: 2d, Winnipeg, Minnedosa, and Qu'Appelle. 4th, Rockcliffe, White River, Port Stanley, and Port Arthur. 6th, Calgary. 7th, Rockcliffe and Toronto. 9th, Port Stanley. 10th, White River and Parry Sound. 11th, Montreal, Rockcliffe, and Parry Sound. 12th, Toronto and Port Stanley. 15th, Port Arthur. 16th, Port Stanley. 17th, Winnipeg and Qu'Appelle. 18th, Toronto, Saugeen, and Parry Sound. 19th, Port Stanley and Esquimalt. 20th, Rockcliffe, White River, and Minnedosa. 21st, Yarmouth. 22d, Father Point. 23d, Father Point and White River. 25th, Toronto. 26th, Grand Manan, St. An-

draws, Port Stanley, and Saugeen. 27th, Charlottetown and Battleford. 28th and 30th, Battleford.

INLAND NAVIGATION.

The *extreme and average stages of water* in the rivers during the current month are given in Table VII, from which it will be seen that no river has attained the danger line; the nearest approaches were the high water in the Arkansas River on the 13th and 15th. The unusual stage of low water that has continued to prevail during September in the upper Mississippi, the Missouri, and Ohio rivers and their tributaries, is shown by the figures given in the column showing the lowest stage of water. As a rule, the zeros of the Weather Bureau gauges are put at, or slightly below, the lowest water on record, and in several cases it will be noticed that the rivers have, during the month, receded to, or below, this lowest previous record.

METEOROLOGY AND MAGNETISM.

By Prof. FRANK H. BIGELOW.

For general remarks relative to this subject see page 7 of the REVIEW for January, 1895.

The comparison of the air temperature with magnetic horizontal force is shown in detail on Chart V, and the special features of the September curves are as follows:

SPECIAL FEATURES FOR SEPTEMBER.

The correction for slope is $+1^{\circ}$ for each group of temperature stations; the reduction to a normal base line is -8° . The reduction of the horizontal force variations to a mean base line is $+12$. The temperature and pressure data are each set back one day to allow for the eastward drift.

STATE WEATHER SERVICES.

By JAMES BERRY, Chief of State Weather Service Division.

The following extracts in regard to the general weather conditions in the several States and Territories are taken from the monthly reports of the State Weather Services.

Snowfall and rainfall are expressed in inches.

Alabama.—The average temperature for the northern section was 76.8° ; southern section, 79.4° ; and State, 78.1° . The maximum, 101° , occurred at Goodwater on the 23d, and the minimum, 34° , at Valley Head on the 30th. Frost occurred in central and northern portions on the 29th and 30th. Nearly all the rain occurred in the first week. Total average amount was 1.48, or 1.26 below normal.

Arizona.—The mean temperature, 77.1° , or about 3.5° above normal. The highest reported, 115° , occurred at Maricopa, and the lowest, 26° , at Whipple Barracks. The average total precipitation was 1.22, or only 0.02 less than normal. The greatest amount, 3.00, was reported from Mount Huachuca, while several stations reported "no rain."

Arkansas.—The weather was unfavorable for all agricultural pursuits except saving hay and fodder. The mean temperature was 77.1° , or 4.6° above the average, and the highest on record. The maximum, 105° , which occurred at Helena on the 13th, exceeded the previous record, and the minimum, 32° , at Corning on the 30th, equaled it. The period from the 9th to 22d, inclusive, was the warmest experienced for the past seventeen years, the average excess being 10° . The last three days were cooler than the normal by 10° . Frosts occurred on the 24th, 27th, 28th, 29th, and 30th, at one or more stations. The average total precipitation was 1.38, or 1.74 less than normal. Precipitation was local in character and badly distributed. The greatest amount, 3.88, was reported at Camden, and the least, 0.03, at Searcy. A brilliant meteor was observed at 9 p. m., on 25th at Bee Branch, Kirby, Little Rock, Lonoke and Rison. Hail was reported at Corning on 5th.

California.—The average temperature was 65.1° , or 4.7° less than normal; highest, 115° , reported from Volcano Springs, and the lowest, 6° , at Bodie. Average precipitation, 1.44, or 1.23 in excess of normal. The greatest amount, 9.57, was reported from Upper Mattole, and the least, 0.00, at a few stations in the southern portion. Frosts were reported on the 3d, 4th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22d, 23d, and 24th.

Colorado.—The mean temperature was 61° , or 3° above the normal. The highest temperature, 105° , was reported from Julesburg on the 17th, and the lowest, 0° , at Gulch on the 21st. Freezing temperatures prevailed generally on the 22d and 23d. The mean precipitation was

0.55, or 0.35 below the average. The first twenty days the fall was light. On the 21st a heavy snowstorm occurred generally over the eastern Slope, 11.4 being recorded at Denver, which is the largest in September during a period of 25 years.

Connecticut.—(See *New England*.)

Delaware.—(See *Maryland*.)

District of Columbia.—(See *Maryland*.)

Florida.—From the 1st to 15th, inclusive, showers were well distributed but in some cases excessive, particularly over portions of the western and southern districts. Many stations, however, during this period complained of lack of moisture. From the 15th, and including the last decade, there was less rain. During the last week there was little except a few badly distributed showers, and reports show that much damage was sustained, especially among early gardens. The mean temperature was 79.5° , or 0.2° above the average. The highest temperature, 96° , was reported at Kissimmee on the 1st and 2d, and the lowest, 57° , at Pensacola and Tallahassee on the 30th. The average amount of precipitation was 4.77, or 2.27 less than normal. The greatest fall, 9.13, occurred at Hypoluxo, and the least, 1.14, at Lake City.

Georgia.—The month was as noticeable for its dryness as the preceding one for its excessive moisture. The total rainfall in some sections did not exceed half an inch. The average amount for the State was 1.53, or 2.61 less than the normal. It was excessively hot until near the close of the month, when a cool wave spread over the State, lowering the temperature very decidedly but not sufficiently to cause frost except in a few exposed places in the extreme northern counties.

Idaho.—The mean temperature was 53.3° . The highest temperature, 96° , was recorded at Idaho City on the 29th, and the lowest, 8° , at Chesterfield on the 22d. Severe frosts accompanied by freezing temperatures occurred on the 6th over the southern section. Frosts were frequent during the latter part of the month. That of the 22d was exceptionally severe, and effectually stopped growth of vegetation over the greater portion of the State. The average precipitation was 1.44. The greatest amount, 4.31, was recorded at Murray, and the least, 0.20, at Lake.

Illinois.—The mean temperature was 70.7° , or 5.3° above the normal. The highest temperature, 102° , was recorded at Holts on the 17th, and the lowest, 24° , at Oswego on the 30th. It is probable that the last day of the month gave the lowest temperature ever recorded in September within the State. Frost was quite general over the central and northern counties on the 24th, and again on the 27th, 29th, and 30th. On the latter date thin ice formed in most north-central and northern

counties. Little grain which could be injured remained standing. The precipitation was about a quarter of an inch below the normal. It occurred principally in hard showers from the 3d to 7th. The largest amount, 6.50, was recorded at Bushnell, and the least, 0.59, at Oswego.

Indiana.—Warm weather continued until near the end of the month, when the temperature fell quite suddenly, at some stations to below freezing, on the last day. The mean temperature was 70.6°, or 5° above the normal. The highest temperatures on record for September were noted at some stations this year, and the minimum temperatures equaled the previous record at some stations. The average precipitation was 2.23, or 0.84 below the normal. The largest amount, 7.46, was recorded at Indianapolis, and the least, 0.50, at Vevay. At Indianapolis 6.07 fell in less than five hours, being the greatest amount recorded since the establishment of the station. Much damage was done by the overflowing of streets and cellars. This heavy rain was local, little or none falling outside of Marion County. Frost on the 2d, 24th, 27th, 28th, 29th, and 30th.

Indian Territory.—(See *Oklahoma*.)

Iowa.—The mean temperature was 6.68°, or 4.8° above the normal. The month was noted for high temperatures, especially during the second decade, the daily excess at the central station from the 10th to 21st being 15°; during that period the minimum temperature was as low as the normal on but two days. The month closed with a cold wave, which gave killing frosts over the larger portion of the State, and temperatures below freezing throughout the northern half. The highest temperature, 1.03°, was recorded at Greenwood and Iowa Falls on the 17th; the lowest, 22°, at Atlantic on the 30th. The average rainfall was 3.03, or 0.67 below the normal. The greatest amount, 7.43, was reported at Alta, and the least, 0.85, at Jefferson.

Kansas.—The first eight days were cool and pleasant, with light showers over the State and good rains in the extreme eastern counties, culminating on the 8th and night of the 8-9th in a severe storm. It was succeeded by hot, dry weather until the 22d, when a cold wave, with rain, swept across the State, with snow in the northwestern counties, followed by a general frost on the 23d, which was severe over the western half of the State. The period 9th to 22d was probably the hottest for that length of time in September ever experienced in the State. The mean temperature, 72.7°, or 4° above the normal. The highest temperature, 110°, was recorded at Phillipsburg on the 13th, and the lowest, 22°, at Garden City on the 29th. The average rainfall was 1.71, or 0.51 below the normal. The greatest amount, 10.12, was recorded at Columbus, and the least, 0.00, at the New England Ranch and Coolidge. Snow occurred on the 21st and 22d, and frost on the 7th, 22d, 23d, 24th, 26th, 27th, 28th, 29th, and 30th.

Kentucky.—The weather presented some very remarkable features. The extremes of temperature were unusual; the daily maxima exceeded 95°, and occurred in nearly all sections during the second decade. The excessive heat continued from the 8th to 23d. Cooler weather prevailed, reaching the frost line during the closing days of the month. The mean temperature, 73.4°, was 4° above the normal. Drought conditions prevailed practically throughout the month. The average precipitation, 1.10, was 1.70 below the normal. Water was so scarce in the springs and creeks that, in some instances, stock had to be driven many miles to obtain it. The rainfall was very unevenly distributed, and came almost wholly in local showers. The greatest amount, 3.18, was recorded at Mount Sterling, and the least, 0.00, at Princeton. Frost was reported from nearly every station on the 30th, and from a few places on the 29th.

Louisiana.—This was generally a dry, hot month, favorable for harvesting rice, corn, and hay, and for picking cotton, but as a rule unfavorable in its effect on the growing crops. The mean temperature, 80°, was nearly 4° above the normal. The highest temperature, 102°, was recorded at Liberty Hill on the 15th, and the lowest, 37°, at Davis on the 30th. The rainfall varied widely in quantity, being heaviest generally over the more southern parishes and the extreme southeastern portion. The greatest amount, 6.31, was recorded at Lawrence, and the least, 0.09, at Delhi. The average amount was 1.89. Very light frost recorded at Davis on 30th.

Maine.—(See *New England*.)

Maryland.—The mean temperature was 70.6°, 3.7° above the normal. The highest temperature, 101°, was recorded at College Park on the 23d, and the lowest, 27°, at Deer Park on the 28th. The average precipitation, 2.04, was 1.77 below the normal. The greatest amount, 5.90, occurred at Baltimore, and the least, 0.15, at Cumberland. Frost on the 10th and 30th.

Massachusetts.—(See *New England*.)

Michigan.—The mean temperature, 34.2°, or 3.4° above the normal. The highest temperature, 100°, was recorded at Adrian on the 11th, and the lowest, 29°, at Boon on the 24th. The average total precipitation was 2.82, or slightly below the normal. Over the upper peninsula some unusually heavy monthly totals were reported, the greatest, 10.36, at Calumet. The greatest deficiencies occurred over the central southern portion. The least amount, 0.15, was recorded at Berrien Springs. Snow on 28th and 29th. Frost on 1st, 14th, 24th, 25th, 27th, 28th, 29th, and 30th.

Minnesota.—The severe hot spell from the 17th to 20th, inclusive, broke all previous records for heat so late in the season. The average

temperature was 61.5. The highest temperature was 108° at Dawson on the 8th, and the lowest, 17°, at Ada on the 30th. The average total precipitation was 3.93. The total amounts ranged from 0.15 at Fergus Falls to 8.63 at Two Harbors. Killing frost on 23d, 27th, 29th, and 30th.

Mississippi.—A protracted hot spell lasted from the 1st to the 27th; during this time temperatures at Vicksburg were continuously above normal, a condition that doubtless prevailed in all portions of the State. A cool wave occurred at the close of the month and gave a lower temperature at Vicksburg on the 30th than had ever been recorded during September; light frost occurred on that date in spots as far south as Adams County. The mean temperature was 70°, or nearly 5° above normal. The highest temperature recorded was 105°, at Vaiden on the 15th, and the lowest, 33°, at French Camp on the 30th. Light frost occurred on the 29th and 30th, but, owing to the prevailing dryness, very little damage resulted. The average precipitation was 1.02, being 2.79 less than normal. The greatest amount recorded was 3.30, at Water Valley, and the least, 0.00, at Kosciusko.

Missouri.—The month was the warmest for many years; the mean temperature was 71.8°, or 4° above the normal. The highest temperature recorded was 104° at Willow Springs on the 12th. The frosts which occurred at the close of the month did but little damage. The average precipitation was 2.34, or 0.98 less than normal. The greatest total fall, 8.80, was recorded at Oto. A heavy hailstorm passed over the northeast section on the 3d and did considerable damage. Hailstones measuring 3 inches in diameter fell at New London in Ralls County. Frosts occurred on the 22d, 23d, 24th, 26th, 27th, 28th, 29th, and 30th, and hail on the 3d and 4th.

Montana.—The mean temperature was 53°, or about 3° below the normal. The highest temperature, 106°, was recorded at Wibaux on the 1st, and the lowest, 10°, at Grantsville on the 7th. Cold weather was general on the 21st and 22d. The average precipitation was 1.15, or about 0.15 above the normal. The greatest amount, 4.50, was recorded at Cokedale, and the least, 0.02, at Great Falls. Snow fell in the southern portion on the 20th and 21st, 35 inches being reported at Cokedale, near which place a man named Cheney was lost in the snow and frozen to death on the 20th.

Nebraska.—During the first twenty days the temperature was almost continuously above the normal. The mean temperature was 68°, or 4.6° above. The highest recorded was 110° at Grand Island, and the lowest, 20°, at numerous stations on the last three days. During the last ten days it was almost continuously below the normal, with killing frosts. The average precipitation was 1.39, or 0.45 below the normal. The greatest amount, 4.85, occurred at Lyons, and the least "trace" at Benkleman. Frosts occurred on the 21st, 22d, 23d, 27th, 28th, 29th, and 30th.

Nevada.—The mean temperature was 59.9°, or nearly 2° below the normal. The highest temperature recorded was 106°, at St. Thomas, on the 8th, and the lowest, 0°, at Carlin, on the 22d. The mean precipitation was 0.21, a deficiency of 0.29. This deficiency was general all over the State, but more particularly in the northern and southern portions. The only excesses occurred in the northeastern and southwestern corners. Snow fell to an average depth of a third of an inch, but was principally reported from stations having altitudes of over 6,000 feet. The greatest amount, 4.00, fell at Osceola. Frosts occurred on the 14th, 18th, 19th, 20th, 21st, 22d, 23d, and 24th.

New England.—The warmest spell during the month, and at many places the warmest for the season, occurred from the 21st to 23d. A number of observers reported it the warmest ever recorded in September. The mean temperature was 62.8°, or 1° to 4° warmer than usual. The highest temperature was 100° at Farmington on the 22d, and the lowest, 24°, at Grafton, on the 15th. The coldest spell was from the 14th to 16th, when the minimum temperatures at most stations were experienced. Frost was reported in most northern, and in the valleys, in the southern districts. The average precipitation was 2.45, or 0.83 less than normal. The greatest amount was 5.53 at Monson, and the least, 1.05, at Orono. The precipitation was everywhere light, and a great many water supplies ran dry; in northern districts, especially, rivers are lower than known for years, if ever. In eastern Maine several electric power stations were obliged to shut down because of lack of water in the rivers. Frost was reported on the 2d, 14th, 15th, and 29th.

New Hampshire.—(See *New England*.)

New Jersey.—The mean temperature was 69.7°, or 5.2° above the normal. The highest temperature recorded was 109° at Somerville on the 21st, and the lowest, 29°, at Franklin Furnace, on the 15th. The average precipitation was 1.07, or 2.82 below the normal. The largest amount recorded was 2.71 at Toms River, and the least, 0.22, at Ranocas. Frost occurred on the 15th, 16th, 23th, 29th, and 30th.

New Mexico.—The temperature averaged above the normal. The weather was generally clear, warm, and pleasant until the 21st, when a sharp cold wave moved down from the northwest, causing frosts in the northern half; this was followed by colder weather with considerable cloudiness and some rain, during the last week. The highest temperature reported was 101° at Roswell on the 4th, and the lowest, 16°, at Monero on the 22d. The precipitation averaged considerably below the usual amount and was very unevenly distributed. The greatest total amount was 4.20 at Down's Ranch, and the least, 0.00 at Raton and Albert.

New York.—The mean temperature was 65°, or about 2.7° above the normal. The highest temperature was 99° at Poughkeepsie on the 23d and West Point on the 24th; the lowest, 22°, at Bloomville on the 15th. The average precipitation was 2.31, or about 1.07 below the normal amount. The largest rainfall was 6.42, and was recorded at Number Four, and the smallest, 0.72 at Warwick.

North Carolina.—The month was the most abnormal on record. The characteristic features were the unprecedented hot wave during the second and third decades, and the severe drought during the same period. The mean temperature was 74.2°, or 4° above the normal. The highest temperature was 104° at Tarboro on the 22d and 23d; the lowest, 32°, at Blowing Rock and Highlands on the 30th. The average rainfall was 1.25, the lowest on record for September, and 3.40 less than the usual amount. Frost occurred on the 28th, 29th, and 30th.

North Dakota.—The mean temperature, 56.6°, was also the normal. The highest temperature, 100°, occurred at Fort Berthold and Washburn on the 2d; the lowest, 12°, at Forman on the 30th. The rainfall was moderately heavy in the eastern and southeastern sections and very light and poorly distributed in other portions; the average amount was considerably less than normal. Frosts were recorded on the 6th, 7th, 17th, 22d, 23d, 26th, 27th, 28th, 29th, and 30th.

Ohio.—The mean temperature was 69°, or 5.1° above normal. The highest temperature was 105° at Hillsboro on the 20th, and the lowest, 25°, at New Waterford on the 15th and 28th. It was excessively hot from the 9th to the 12th and the 17th to the 22d; the latter period was the most oppressive and severe. The warmth was very unusual for September, and previous records were broken. The month closed with freezing temperatures in many localities. Much less than the usual amount of precipitation fell. The average amount was 1.66, or 1.49 below the normal. The heaviest rainfall occurred in the northeastern, and the lightest in the western, counties. Frosts occurred on the 1st, 2d, 3d, 4th, 14th, 15th, 23d, 24th, 25th, 27th, 28th, 29th, and 30th. Traces of snow occurred at isolated places on the 29th and 30th.

Oklahoma.—The mean temperature was 77.3°, or 5.7° above the normal. The highest temperature was 108° at Anadarko on the 4th; the lowest, 30°, at Clifton on the 30th. The average precipitation was 1.10, or 1.79 less than normal. The greatest amount, 6.00, was recorded at Vinta, and the least, 0.00, at Sac and Fox Agency.

Oregon.—The mean temperature was 55.4°, being 3.0° below the normal. This was one of the coldest Septembers Oregon has experienced. The cold weather was not confined to any particular section of the State. The average total precipitation was 2.90, or 0.92 less than the usual amount. The greatest amount, 10.28, was recorded at Bandon, and the least, 0.19, at New Bridge. Frosts occurred on the 5th, 6th, 7th, 8th, 9th, 10th, 14th, 15th, 17th, 18th, 19th, 20th, 21st, 22d, 23d, and 27th.

Pennsylvania.—The mean temperature was 57.8°, or 5.1° above the average. The highest temperature was 100°, recorded on the 21st and 22d at Carlisle, Coatesville, and Hamburg; the lowest, 24°, at Shinglehouse on the 15th. The average precipitation was 1.71, or 2.38 less than the usual amount. Injurious drought prevailed throughout the month. Streams and springs were unusually low. The largest total amount was 5.41, at Saegerstown, and the smallest, 0.37, at Reading. Snow occurred on the 29th and 30th, and frost on the 2d, 14th, 15th, 25th, 28th, 29th, and 30th.

Rhode Island.—(See *New England*.)

South Carolina.—The mean temperature was 76.9°, or 2.8° above normal. It was the warmest September in the interior of which there is any record. The highest was 106°, at Spartanburg, on the 25th; the lowest, 35°, at Holland, on the 30th. The average precipitation, 1.29, or 3.65 less than the normal. The largest amount recorded was 6.94, at Charleston, and the smallest, 0.00, at Central, Longshore, and Shaws Forks. The only territory having an excess of rainfall was a narrow strip extending from Beaufort to Charleston. Frost was recorded at Oconee, on the 30th.

South Dakota.—Unusually high temperatures prevailed at times during the first and second decades, with scattered showers, mostly light, and followed by cooler weather in the third decade, with quite general heavy rains. The mean temperature was 63.2°, or about 4.3° above normal. The maximum temperature was 112°, at Forestburg, on the 17th, and the minimum, 12°, at Watertown, on the 30th. The

average precipitation was 1.65, or 0.21 in excess of the normal amount. The greatest total amount, 4.40, was recorded at Tyndall, and the least, 0.15, at Farmingdale. Frost occurred on the 4th, 5th, 6th, 7th, 8th, 14th, 15th, 21st, 22d, 23d, 24th, 27th, 28th, 29th, and 30th.

Tennessee.—The high temperatures and small amount of rain which prevailed almost during the entire month caused a severe drought. The mean temperature was 74.2°, or 6.5° above the average, and is the highest September average for the past thirteen years. The highest temperature was 100°, recorded at Covington on the 18th; the lowest, 27° at Bristol, on the 30th. The average rainfall was 2.12, or 1.40 less than the usual amount. Most of the rain fell during the first seventeen days, after which date little or none was reported. The greatest amount was 7.48, at Lynnvill, and the least, 0.05, at Bristol. Frost was recorded on the 28th, 29th, and 30th.

Texas.—The mean temperature was 2.8° above the normal; the highest daily being 106° at Roby on the 5th, and the lowest, 30°, at Happy on the 23d. The rainfall was very unevenly distributed. There was comparatively none during the first and second decades, but some good local rains occurred during the third which, to some extent, reduced the deficiency. The average total amount was 1.72 less than usual. The largest amount, 6.79, was recorded at Fort Stockton, and there was no rain at four stations. Frosts occurred on the 21st, 22d, 23d, and 24th.

Utah.—The mean temperature was 60.8°; the maximum daily, 103°, at St. George on the 8th, and the minimum, 9°, at Fillmore on the 22d. The average precipitation was 0.60; the greatest recorded was 2.26 at Millville, and the least, "trace," at Orton. The precipitation was principally in the form of snow, which fell on the 20th and 21st. Frosts were recorded on the 5th, 7th, 20th, 21st, 22d, 23d, 24th, 25th, 26th, 27th, 28th, 29th, and 30th.

Virginia.—The mean temperature was 72.7°; the highest daily, 107°, occurred at Bon Air on the 19th; the lowest, 25°, was reported at Big Stone Gap on the 30th. The average precipitation was 0.76, considerably less than the usual amount; the greatest, 2.24, was recorded at Callaville, and the least, 0.00, at Cape Henry. Frost on the 2d, 28th, 29th, and 30th.

Vermont.—(See *New England*.)

Washington.—The principal characteristics of the weather were unusual dryness in the western section; rainfall double the average in the eastern section, and a temperature decidedly below the normal in both. It was the coldest September for several years. The mean temperature was 53.9°, or 3.4 below the normal. The maximum temperature was 96° at Fort Spokane on the 1st, and the minimum, 22°, at Hunters on the 21st. The average precipitation was 2.07, or 0.11 below normal. The greatest amount, 11.45, occurred at Monte Cristo, and the least, 0.51, at Hoxie.

West Virginia.—The mean temperature was 70.3°, or about 4° above the normal. The highest temperature recorded was 107°, at Nuttallburg, on the 20th, and the lowest, 20°, at the same station on the 30th. The rainfall was greatly below the normal, and drought prevailed in all sections. The average amount was 1.70. Frost occurred on the 28th, 29th, and 30th.

Wisconsin.—The mean temperature was 64.7°, or 4° above the average. The highest temperature recorded was 100°, at Prairie du Chien on the 11th, and the lowest, 23°, at Barron and at Belleville on the 23d and 30th, respectively. Continued high midday temperatures and moderately cool nights prevailed until the 22d, when it became much cooler. The average rainfall was 2.99, or 0.10 above the normal. The greatest amount recorded was 10.21 at Butternut, and the least, 0.67, at Janesville. The rainfall was very poorly distributed, and occurred in the form of heavy local thunderstorms, which only slightly relieved the droughty conditions generally prevailing. Frost occurred on the 24th, 26th, 27th, 28th, 29th, and 30th.

Wyoming.—The mean temperature, 53°, was very near the normal. The highest temperature recorded was 101°, at Fort Laramie on the 14th, and the lowest, 0°, at Fort Yellowstone on the 22d. It is probable that such extremes were never known during any previous September. The average total amount of precipitation was 0.83, or about normal. The greatest amount recorded was 2.20, at Lander, and the least, 0.16, at Fort Laramie. The average depth of snowfall was 7.50 during the storm of the 20th to 22d.

STUDIES BY FORECAST OFFICIALS.

COLD WAVES ON THE MIDDLE GULF COAST.

By Prof. E. B. GARRIOTT (dated December 16, 1893).

Practically, all of the important cold waves of the United States first appear over British America and advance thence over districts in the United States which are covered by the sweep of northerly winds in the west quadrants of areas of low barometric pressure. The cold waves of the middle

coast of the Gulf of Mexico follow in the wake of areas of low pressure which reach the lower Mississippi Valley.

As cold waves are a product of the cyclonic circulation of winds about areas of low pressure, a consideration of the habits and characteristics of the low areas of the colder months, and more especially of those which have been attended by cold waves, is necessary to a determination of the